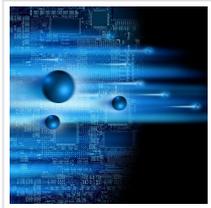


The Need for Quantum Technology in Pakistan

2021-07-03



Even though it is perfectly sensible for the education minister, Shafqat Mehmood, to be happy about the increase in the education budget, I along with several others who want to see Pakistan become a technologically advanced country would be happier and more content if some of the funds are utilised to develop a national research programme. The main aim for such a programme would be to lay the foundation for a thriving knowledge based national economy. Such a programme should have been built decades ago to propel a Nanotechnology transformation through Industry-Academia collaborations in Pakistan. A few eminent educators, and scientists, did indeed put in some effort within this space, but we mostly missed out on the opportunity. But now a greater opportunity presents itself, and we really owe it to our future generations to ensure we do not let it slip through our hands again.

After Richard Feynman and other prominent scientists in the mid-1900s familiarised the world with nanotechnology, a new digital world was born. Whether it was millions of transistors on a single chip, or supercomputers processing gigabits of information in fractions of a second; it was predominantly nanotechnology that drove these advancements at an exponential pace. Nanotechnology has since matured and the world is now quickly moving towards the next breakthrough: Quantum Technology (also called Quantum Information Systems: QIS).

QIS or Quantum Technology is not really a new field of science as we have had its understanding for a few decades now. In fact, some of the theoretical framework for quantum technology was debated by the likes of Niels Bohr and Albert Einstein. Fast forward to today, the world is now ready for the different avenues QIS has to offer. QIS concerns the study, control, and manipulation of quantum systems with the goal of achieving information processing, and communication beyond the limits of the classical world of science. It is a multidisciplinary field, lying at the cusp of fields such as physics, mathematics, and engineering.

QIS is not in competition with areas such as Artificial Intelligence (AI), Machine Learning (ML),

Advanced Robotics, and Digital Manufacturing, but can form strong foundations, which can further benefit these areas (e.g. quantum enhanced AI and ML algorithms can further advance quantum computing capabilities). Thus, QIS along with augmenting AI and ML techniques have brought technology to a new and broader physical framework, providing fundamentally new capabilities. QIS technologies offer much more than just squeezing information into computers and multiplying the speeds of ubiquitous microchips and processors. It supports entirely new modes of computation with innovative and powerful algorithms based on quantum principles, which do not have any classical equivalents; rather they offer secure communications, simulation capabilities unattainable with classical devices, and systems with unparalleled sensitivity and precision.

The importance of QIS is the same, if not more, as it was of Nanotechnology a few decades ago which helped many countries rise to become developed states (e.g. Korea, [China](#), [Singapore](#)). It is for this reason that leading countries in the world are spearheading projects to become the future leaders in this field. For example the [European Union](#) made an alliance of more than 5,000 scientists from all over Europe and launched a QIS project worth one billion euros, which makes it one of the three biggest research projects in the history of EU. American and Chinese scientists are actively working on all aspects of QIS; from quantum computation, and communication to quantum metrology, sensing, and imaging. This is in addition to the billions of dollars of partnerships amongst leading companies (Amazon, Alibaba, Airbus, Google, IBM, Intel etc.) with state of the art research laboratories, and the top universities of the world.

In the race to advance QIS, developing countries are not an exception as many of them are pushing hard to build collaborations with leading Western, and Asian technology experts. For example, some developing countries such as [India](#) and to an extent [Bangladesh](#) have started active collaborations on QIS technology with material science, and electrical engineering departments of the University of Cambridge in [UK](#). Through these collaborations, prominent researchers and professors from developing countries get to visit and work at leading universities and institutes which are already working on QIS technologies. This way they are able to learn and make scientific contributions, eventually bringing new knowledge back to their home countries.

I wanted to shed some light on the current state of affairs of QIS in [Pakistan](#); however, the work so far is minimal and is widely dispersed. It is high time that a national research and development programme focusing on QIS is started in [Pakistan](#) which would involve the country's leading universities, relevant private sector companies, and the budding technology focused start-ups. Through such a programme, we could also sign collaboration agreements with the prominent global universities and organisations working within this space. I suggest the following key aspects of QIS to be included in the programme:

- 1) Micro & Nano Fabrication of Quantum devices
- 2) Quantum Communication and Quantum Control Systems
- 3) Quantum Metrology, Sensing & Imaging including for space technologies
- 4) Quantum Networks, among others

Both local Pakistani QIS experts, as well as those working abroad, can be utilised to help advise on detailed work packages with distinct short, medium and long-term goals for each of the aforementioned aspects of QIS. This programme, if developed, should be done with swift timelines, challenging but realistic deliverables, and key performance indicators. I have no doubt, that if we bring together the intellectual wealth that we collectively possess as a nation, we will be able to advance rapidly within this new area of quantum technology.

The least that can be achieved with a national programme for QIS is short and long term improvements in rankings of Pakistani universities, reinforced industry-academia collaborations and better skilled academics and graduates. And the ideal scenario would be a knowledge-based economy capable of building future technologies at home rather than being just a consumer nation.

Read the [original article](#) on The Express Tribune.